

a liquid phosphorous precursor compound container [adapted to hold the liquid phosphorous precursor compound];

a conduit; and

an orifice disposed between the liquid container and the conduit, wherein at least one of the liquid container, the orifice, and the conduit has a surface of a stainless steel alloy having less than 10 % nickel.

REMARKS

Claims 1-30 and 46 are pending. Claims 1, 3, 5-8, 12, 17-19, 23, 26, 27, 29 and 46 have been amended. No claims have been added or canceled. Hence claims 1-30 and 46 remain pending. Reconsideration of the subject application as amended is respectfully requested.

Claims 1-12, 15-30 and 46 have been rejected under 35 U.S.C. § 103(a) as being unpatentable over Nagashima, Sivaramakrishnan and Siegle in view of Lankford or Maruhashi for the reasons stated in the previous office action.

Claims 13 and 14 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over the references cited above, taken in further view of Yamaguchi and Stauffer for the reasons stated in the previous office action.

CLAIM REJECTIONS UNDER 35 U.S.C. § 103(a)

As amended, independent claim 1 provides an apparatus for use with a liquid phosphorous precursor compound. The apparatus includes, *inter alia*, a liquid phosphorous precursor compound container, a conduit, and an orifice disposed between the container and conduit. At least one of the liquid container, orifice and conduit has a surface of a stainless steel alloy having less than 5% nickel. Similar limitations involving the steel alloy nickel content exist in independent claim 8, independent claim 20 and independent claim 26. Independent claim 46 provides a similar apparatus whereby one of the three claimed components has a surface of stainless steel alloy having less than 10% nickel. Finally,

independent claim 28 provides a method for injecting gaseous phosphorous precursor into a chemical vapor deposition chamber. The method includes, *inter alia*, providing a liquid TEPO, TMP or TEP through an injection valve including a stainless steel alloy having less than 10% nickel. Hence, at least one aspect of the invention is the use of stainless steel alloys for portions of one or more components having less than a prescribed amount of nickel.

As outlined in depth in Applicants' specification, and expanded upon in the Affidavit of a joint inventor submitted herewith under 35 C.F.R. § 1.132, use of the claimed alloy range produced quite unexpected results. As further detailed in the accompanying Affidavit, tests conducted in an attempt to reduce residue build-up problems initially led the inventors towards a steel alloy having a higher concentration of nickel than the prior-art valves. The initial test of a high nickel content steel was driven in part by the corrosion resistant characteristics of that high nickel steel for the liquid compounds at issue. To the inventors' surprise, residue build-up occurred more quickly. Through a series of tests, the inventors discovered that it was actually lower nickel steel alloys which produced the desired results. The conclusion that steel having a lower nickel content than currently used produced better results was clearly unexpected.

In contrast to each of the independent claims, the cited references, alone or in combination, fail to disclose, teach or suggest the subject invention. While Nagashima, Sivaramakrishnan and Siegele each refer to the use of stainless steel in semiconductor processing equipment, none of these references, as recognized by the Examiner, discusses the nickel content of those steels. The Examiner has combined these references with Lankford or Maruhashi in rejecting Applicants' independent claims. However, at best, Lankford and Maruhashi teach that low nickel stainless steels exist. All five references are silent as to the uses of the particular stainless steels. There is no indication in any of these five references that low nickel steels were used for semiconductor processing equipment. There is no indication in any of the references that low nickel steels were used in conjunction with liquid phosphorus containers or related components. In fact, the inventor's accompanying Affidavit indicates that SST 316 was the commonly used stainless steel, with this steel having a nickel content of about 10-15%. Furthermore, the then currently-used SST 316 had distinct advantages which led to its use. See, Inventor's Affidavit, pg. 1.

The Applicants submit that the Examiner has not established a prima facie case of obviousness since obviousness cannot be established absent some teaching, suggestion or incentive supporting the combination. ACS Hospital Systems, Inc. v. Montefiore Hospital, 732 F. 2d 1572, 1577, 221 USPQ 929, 933 (Fed. Cir. 1984). Specifically, none of the five references teaches or suggests that it is advantageous to use a stainless steel with a low nickel content in an apparatus for use with liquid phosphorous. Absent such a showing in the prior art, the Examiner has impermissibly used the applicants teaching to hunt through the prior art for the claimed elements and combine them as claimed. See In re Vaeck, 947 F. 2d 488, 20 USPQ 2d 1438 (Fed. Cir. 1991); In re Bond, 910 F. 2d 831, 15 USPQ 2d 1566 (Fed. Cir. 1990). The use of hindsight is never permissible to establish obviousness.

Additionally, none of the references cited in the rejection teach or suggest the problem solved by the invention or its source. Specifically, none of the references cited in the above rejection teaches the effect of Nickel on a liquid phosphorous precursor compound. As such, none of the cited references makes the suggestion that reducing the nickel content of a stainless steel used in an apparatus for handling such a precursor will have any beneficial effect. By contrast, through a series of tests that produced unexpected results, the Applicants have discovered that a low nickel content in the stainless steel used in the apparatus of the present invention reduces the build-up of residue. (see page 5, lines 4-20 of the specification). Thus, the Examiner has failed to establish a prima facie case of obviousness since a patentable invention may lie in the discovery of a problem even though the remedy may be obvious once the source of the problem is identified. See In re Peehs, 612 F.2d at 1290, 204 USPQ at 837 (CCPA 1980).

As outlined in the accompanying Affidavit, the inventors believe that any reduction in nickel content from the commonly used steel alloy SST 316, constitutes an unexpected result. In performing the tests, as outlined in Applicants' specification and the accompanying Affidavit, the inventors determined that a trend exists whereby low nickel steel results in reduced residue build-up compared to medium nickel steel (e.g. SST 316 having about 10%-15% Ni) , which in turn has less build-up than a higher nickel steel (e.g., HASTELLOY, having about 52% Ni). Based on the tests conducted by the inventors, "one having ordinary skill in the art could ascertain a trend in the exemplified data". See In re

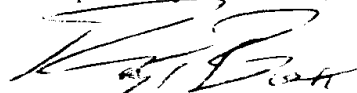
Coleman et al., 201 USPQ 193, 199 (CCPA 1979). As a result, Applicants are entitled to claim the entire range of the unexpected result, namely, steels having a lower nickel content than the then used SST 316. More specifically, Applicant is entitled to claim apparatus and methods having steels with less than 10% nickel. Hence for at least the reasons discussed above, independent claims 1, 8, 20, 26, 28 and 46 are all allowable over the cited art. Claims 2-7, 9-19, 21-25, 27, 29 and 30 all depend from an allowable independent claim and are similarly allowable.

CONCLUSION

In view of the foregoing, Applicants believe all claims now pending in this Application are in condition for allowance. The issuance of a formal Notice of Allowance at an early date is respectfully requested.

If the Examiner believes a telephone conference would expedite prosecution of this application, please telephone the undersigned at 303-571-4000.

Respectfully submitted,



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